HAWC and the Future

"With all its success, Milagro provided only a proof-of-principle for the basic technique of using Cerenkov radiation in water to detect shower particles," says Dingus. "Our experience over the last decade and our computer simulations of Milagro's performance convinced us that we could build a much more sensitive detector, and with support from the Laboratory-Directed Research and Development program, we've designed it."

Funding is being sought from the National Science Foundation and Mexican institutions for the new array: HAWC, for High Altitude Water Cerenkov array. It will be built on the shoulder of Sierra Negra, Mexico's highest peak. At 13,500 feet, HAWC will be 4,000 feet higher than Milagro was.

At the higher altitude, the number of particles reaching the ground from a shower of a given energy is 5 times higher than that at the Milagro altitude. The HAWC PMTs will be distributed one per tank in 900 water-filled tanks placed place side-by-side over an area about 10 times that of the Milagro pond. Because each PMT will be in its own large tank, the light from each shower particle will be seen by only one PMT, which will allow more-accurate determination of the shower energy.

The increase in altitude, the larger area, and the optical isolation of the PMTs will increase the overall sensitivity 10 to 15 times—high enough to detect many new gamma-ray sources and to monitor the variability of these sources.

Atmospheric Cherenkov telescopes have detected, at distances of billions of light-years, extragalactic sources that flare in only a few minutes, but they have been able to monitor only a few sources for a small amount of time. HAWC will observe the TeV sky every day, and its higher sensitivity will increase the energy range over which these sources can be detected. Milagro found a few sources, but HAWC will add important details for understanding the physical mechanisms in nature's high-energy particle accelerators.

The enormous progress in gamma-ray astronomy over the past decade has fueled intense interest in future instruments. Large investments are planned for the next generation of atmospheric Cherenkov telescopes. Meanwhile, Los Alamos has blazed a new path that will culminate in HAWC, a highly sensitive all-sky survey instrument able to reveal the transient high-energy universe. Sinnis summarizes its promise this way: "With HAWC, we will be in a unique position to close in on the century-old question of the origin of cosmic rays."

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